

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property  
Organization  
International Bureau



534 489

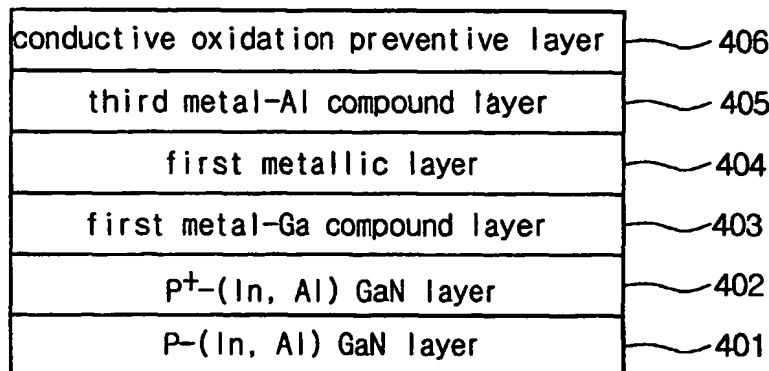
(43) International Publication Date  
3 June 2004 (03.06.2004)

PCT

(10) International Publication Number  
**WO 2004/047189 A1**

- (51) International Patent Classification<sup>7</sup>: **H01L 33/00**
- (21) International Application Number: **PCT/KR2003/002468**
- (22) International Filing Date:  
17 November 2003 (17.11.2003)
- (25) Filing Language: **Korean**
- (26) Publication Language: **English**
- (30) Priority Data:  
10-2002-0071432  
16 November 2002 (16.11.2002) KR  
10-2003-0058209 22 August 2003 (22.08.2003) KR  
10-2003-0058210 22 August 2003 (22.08.2003) KR
- (71) Applicant (for all designated States except US): **LG INNOTEK CO.,LTD** [KR/KR]; 14th Fl. Hansol Bldg., 736-1, Yoksam-dong, Kangnam-gu, 135-983 Seoul (KR).
- (72) Inventors; and  
(75) Inventors/Applicants (for US only): **CHOO, Sung-Ho** [KR/KR]; 978-1, Jangduk-dong, Gwangsan-gu, 506-831 Gwangju (KR). **JANG, Ja-Soon** [KR/KR]; 978-1, Jangduk-dong, Gwangsan-gu, 506-831 Gwangju (KR).
- (74) Agent: **HAW, Yong-Noke**; 8th Fl. Sonchon Bldg., 642-15, Yoksam-dong, Kangnam-gu, 135-080 Seoul (KR).
- (81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.
- (84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).
- Published:**  
— with international search report
- For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: **LIGHT EMITTING DEVICE AND FABRICATION METHOD THEREOF**



(57) Abstract: The present invention discloses a light device and a fabrication method thereof. An object of the present invention is to provide the light device and the fabrication method thereof an electric/thermal/structural stability is obtained, and a P-type electrode and an N-type electrode can be simultaneously formed. In order to achieve the above object, the inventive light device includes: a GaN-based layer; a high concentration GaN-based layer formed on the GaN-based layer; a first metal-Ga compound layer formed on the high concentration GaN-based layer; a first metal layer formed on the first metal-Ga compound layer; a third

metal -Al compound layer formed on the first metal layer; and a conductive oxidation preventive layer formed on the third metal-Al compound layer.

WO 2004/047189 A1

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/KR2003/002468

**A. CLASSIFICATION OF SUBJECT MATTER****IPC7 H01L 33/00**

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H01L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched  
Korean Patents and applications for inventions, since 1975

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	KR 226831 B ( LG ELECTRONICS INC. ) 29 JULY 1999 see the figure 1d, 3d, detailed description of the invention	1-10, 27-34
X	KR 2000-71682 A ( SUMITOMO ELECTRIC INDUSTRIES LTD ) 25 NOVEMBER 2000 see the embodiment 4	20-22
A	JP 11-40853 A ( SHOWA DENKO K.K. ) 12 FEBRUARY 1999 see the whole document	20-22
Y	JP 11-97744 A ( SHARP CORP. ) 9 APRIL 1999 see the claims 1-4, figure 6	23-26, 44-52
Y	JP 8-32115 A ( SHARP CORP. ) 2 FEBRUARY 1996 see the claims 1-4, figure 6	23-26, 44-52

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

\* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&amp;" document member of the same patent family

Date of the actual completion of the international search

25 FEBRUARY 2004 (25.02.2004)

Date of mailing of the international search report

25 FEBRUARY 2004 (25.02.2004)

Name and mailing address of the ISA/KR



Korean Intellectual Property Office  
920 Dunsan-dong, Seo-gu, Daejeon 302-701,  
Republic of Korea

Facsimile No. 82-42-472-7140

Authorized officer

KIM, Dong Yup

Telephone No. 82-42-481-5749



# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/KR2003/002468

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	KR 286699 B ( NICHIA CHEMICAL INDUSTRIES) 16 JANUARY 2001 see the whole document	1-52
A	JP 11-74558 A (TOSHIBA CORP. ) 16 MARCH 1999 see the whole document	1-52
A	KR 2001-14823 A (SHARP K.K. ) 26 FEBRUARY 2001 see the whole document	1-52
A	KR 2002-31683 A ( LG INNOTECH CO., LTD) 3 MAY 2002 see the whole document	1-52

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR2003/002468

## Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

- I. Claims 1-10 and 27-34 directed to an electrode composed of metal-Ga compound layer / metal / metal-Al compound layer / anti-oxidation layer
- II. Claims 11-19 and 35-43 directed an electrode composed of metal oxide layer / metal- metal oxide compound layer / 2nd metal layer containing metal dots
- III. Claims 20-22 directed to an electrode composed of highly doped metal oxide layer / transparent electrode
- IV. Claims 23-26 and 44-52 directed to an electrode composed of metal layers highly combined with Hydrogen

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☒ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International application No.

PCT/KR2003/002468

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
KR 226831 B	29.07.1999	NONE	
KR 2000-71682 A	25.11.2000	TW 467874 B JP 2000299028 A JP 3141874 B US 2003166308 AA EP 1045456 A2 CN 1271182 A	11.12.2001 24.10.2000 07.03.2001 04.09.2003 18.10.2000 25.10.2000
JP 11-40853 A	12.02.1999	US 2003006422 AA US 6326223 BA US 6268618 BA US 6403987 BA DE 19820777 A1 DE 19820777C2 JP 3230463 B	09.01.2003 04.12.2001 31.07.2001 11.06.2002 12.11.1998 18.06.2003 19.11.2001
JP 11-97744 A	09.04.1999	NONE	
JP 8-32115 A	02.02.1996	US 5966629 A US 2001001079 AA US 6429111 BB US 5701035 A US 6222204 BA	12.10.1999 10.05.2001 06.08.2002 23.12.1997 24.04.2001
KR 286699 B	16.01.2001	TW 403945 B TW 491406 Y CN 1102507 A US 5652434 A US 5563422 A US 62404512 BA US 6507041 BB US 6610995 BB US 5877558 A US 5767581 A US 6093965 A EP 952617 A1 CN 1213863 A	01.09.2000 11.06.2002 10.05.1995 29.07.1997 08.10.1996 20.03.2001 04.01.2003 26.08.2003 02.03.1999 16.06.1998 25.07.2000 27.10.1999 14.04.1999

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR2003/002468

US 2001022367 AA	20.09.2001
JP 6314822 A2	08.11.1994
EP 622858 A2	02.11.1994
EP 622858 A3	17.05.1995
EP 622858 B1	12.07.2000
CN 1046375 B	10.11.1999
DE 69425186 T2	22.03.2001
DE 69425186 C0	17.08.2000
JP 28303742 B	24.09.1998
KR 225612 B	15.10.1999

JP 11-74558 A

16.03.1999

JP 3457516 B

20.10.2003

KR 2001-14823 A

26.02.2001

JP 200115852 A

09.01.2001

TW 457733 B

01.10.2001

KR 2002-31683 A

03.05.2002

NONE